# PROCEEDINGS

OF

# THE ROYAL SOCIETY.

1841. No. 49.

June 17, 1841.

The MARQUIS OF NORTHAMPTON, President, in the Chair.

The Right Honourable Lord Crewe, James Alderson, M.D., and Edward James Seymour, M.D., were balloted for, and duly elected into the Society.

The following papers were read, viz.—

1. "Experiments on the electric conditions of the Rocks and Metalliferous Veins (Lodes) of Longclose and Rosewall Hill Mines in Cornwall." By William Jory Henwood, Esq., F.R.S., &c., Secretary of the Royal Geological Society of Cornwall.

The experiments, of which the results are given in this paper, were undertaken with the view of determining whether it was in consequence of the imperfections of the galvanometers, or other apparatus, employed, that Mr. R. W. Fox, and other experimenters, had been unable to detect the presence of electricity in the tin veins of Cornwall. The mode of experimenting was in principle the same as that pursued by Mr. Fox, namely, that of placing plates of metal in contact with the points to be examined, carrying wires from the one to the other, and interposing a galvanometer in the circuit. The plates employed were of sheet-copper and sheet-zinc, and they were about six inches long, and three inches and a half wide. The wires were of copper, one twentieth of an inch in diameter, and the same that had been used by Mr. Fox.

The tabular results of these experiments show that both the granite and the tin vein at *Rosewall Hill* mine, and also the greenstone and the copper vein in that of Longclose, present unequivocal traces of electric currents, whether different parts of the same veins or various portions of the same rocks were examined.

It also appears, from these experiments, that the nature and positions of the small metallic plates employed materially affect, not only the intensity, but in some cases also the directions of the currents; and also that there is a considerable difference in the results when the same plates of metal are placed on different ingredients in the veins, even though these may be in immediate contact with each other.

2. "Researches in the Theory of Machines." By the Rev. H. Moseley, M.A., F.R.S., Professor of Natural Philosophy and Astronomy in King's College, London.

Of the various names, such as "useful effect," "dynamical effect," "efficiency," "work done," "labouring force," "work," which have been given to that operation of force in machinery which consists in the union of a continued pressure with a continued motion, the author gives the preference to the term *work*, as being that which conveys, under its most intelligible form, this idea of the operation of force, and as being the literal translation of the word "travail," which among French writers on mechanics has taken the place of every other.

The single unit, in terms of which this operation of force is with us measured, viz. the work of overcoming a pressure of one pound through one foot, he considers to be distinguished sufficiently, and expressed concisely enough, by the term *unit of work*, rejecting as unnecessary, and as less likely to pass into general use, the terms "dynamical unit," and "dynam," which it has been proposed to apply to it.

Having thus defined the terms *work* and *unit of work*, and paid a tribute of respect to the valuable labours of M. Poncelet in the theory of machines, and expressed admiration of the skill with which he has applied to it the well-known principle of *vis viva* under a new and more general form, the author proceeds to remark, that the interpretation which M. Poncelet has given to that function of the velocity of a moving body which is taken as the measure of its vis viva, associates with it the definitive idea of a force opposed to all change in the state of the bodies' rest or motion, and known as its "*vis inertiæ*," "*vis insita*," &c. The author conceives that the introduction of the definitive idea of such a force into questions of elementary and practical mechanics is liable to many and grave objections; and he proposes a new interpretation of it, viz. "that one half of this function represents the number of units of work accumulated in the moving body, and which it is capable of reproducing upon any resistance opposed to its progress." This interpretation he establishes by mechanical considerations of an elementary kind. Taking, then, this new interpretation of the function representing one half the vis viva, and dividing the parts of a machine into those which receive the operation of the moving power (the moving points) and those which apply it (the working points), he presents the principle of vis viva in its application to machines under the following form:—"The number of units of work done by the moving power upon the moving points of the machine is equal to the number yielded at the working points, *plus* the number expended upon the prejudicial resistances, *plus* the number accumulated in the various parts of the machine which are in motion." So that the whole number of units of work done by the moving power, or upon the moving points, is expended, partly in that work done at the working points, whence results immediately the useful product of the machine, and partly upon the prejudicial resistances of friction, &c. opposed to the motion of the machine in

its transmission from the moving to the working points; and all the rest is accumulated or treasured up in the moving parts of the machine, and is reproducible whenever the work of the moving power from exceeding shall fall short of that which must be expended upon the useful and the prejudicial resistances to carry on the machine.

He then proceeds to observe, that in every machine there thus exists a direct relation between these four elements,—the work done upon the moving points, that expended at the working points, that expended on the prejudicial resistances, and that accumulated in the moving elements. This relation, which is always the same for the same machine, and different for different machines, he proposes to call, in respect to each particular machine, its *modulus*; and he states the principal object of this paper (and of another which he proposes subsequently to submit to the Society) to be, first, the general determination of the modulus of a simple machine; secondly, that of a compound machine, from a knowledge of the moduli of its component elements; and, thirdly, the application of these general methods of determination to some of the principal elements of machinery, and to the machines which are in common use.

The author then states, that the velocities of the different parts, or elements of every machine are connected with one another by certain invariable relations, capable of being expressed by mathematical formulæ; so that, though these relations are different for different machines, they are the same for the same machine. Thus it becomes possible to express the velocity of any element of a machine, at any period of its motion, in terms of the corresponding velocity of any other element. Whence it results that the whole vis viva of the machine may at any time be expressed in terms of the corresponding velocity of its moving point (that is, the point where the moving power is applied to it), and made to present itself under the form $V^2 \Sigma \omega \lambda^2$, where $V$ represents the velocity of the moving point of the machine, $\omega$ the weight of any element, and $\lambda$ a factor determining the velocity of that element in terms of the velocity $V$ of the moving point. Substituting this expression for the vis viva or accumulated work in the modulus and solving in respect to $V$, an expression is obtained, whence it becomes apparent that the variation of the velocity $V$ of the moving point, produced by any given irregularity in the work done upon the moving or working points, will be less, as the factor $\Sigma \omega \lambda^2$ is greater. This factor, determinable in every machine, and upon which the uniformity of its action under given variations of the power which impels it depends, he proposes to introduce into the general discussion of the theory of machines as the *coefficient of equable motion*.

He then proceeds to investigate general methods for the determination of the modulus of a machine, deducing them from those general relations which are established by the principles of statics, between the pressures applied to the machine, in its state bordering upon motion.

That he may escape that complication of formulæ which results from the introduction of friction, by the ordinary methods, into the

consideration of questions of equilibrium, the author calls to his aid a principle, first published by himself in a paper on the 'Theory of the Equilibrium of Bodies in contact,' printed in the fifth volume of the Cambridge Philosophical Transactions, viz. "that when the surfaces of two bodies are in contact under any given pressures, and are in the state bordering upon motion, on those surfaces, then the common direction of the mutual resistances of the surfaces is inclined to their normal at the point of contact at a certain angle, given in terms of the friction of the surfaces by the condition that its tangent is equal to the coefficient of friction." This angle the author has called "*the limiting angle of resistance*:" it has since been used by other writers under the designation of the "*slipping angle*."

He next proceeds to determine the modulus of a simple machine, moveable about a cylindrical axis of given dimensions, and acted upon by any number of pressures in the same plane. He applies the principle last stated to determine the general conditions of the equilibrium of these pressures, in the state bordering upon motion by the preponderance of one of them; and, solving the resulting equation in respect to that one pressure by the aid of Lagrange's theorem, he deduces immediately the modulus from this solution by principles before laid down. The modulus, thus determined, he then verifies by an independent discussion of that particular case in which three pressures only are applied to the machine, one of which has its direction through the centre of the axis.

This solution he next considers more particularly with reference to a machine moveable about a fixed axis under one moving and one working pressure (their directions being any whatever) and its own weight; which last is supposed to act through the centre of the axis. He shows that it is a general condition of the greatest economy in the working of such a machine, that the moving and working pressures should have their directions, one of them upwards, and the other downwards, and that both should therefore be applied on the same side of the axis of the machine. He moreover shows that if the direction of one of these pressures be given, there is then a certain perpendicular distance of the other from the centre of the axis, and a certain inclination of its direction to the vertical, at which perpendicular distance, and which inclination, this pressure being applied, the machine will yield a greater amount of work, by the expenditure of a given amount of power, than it will yield under any other circumstances of its application: so that this particular distance and inclination are those whence results the most economical working of the machine.

Professor Moseley then commences his application of these general principles to elementary machines with the pulley. He establishes the modulus of the pulley under any given inclination of the parts of the cord passing over it, taking into account the friction of the axis, the weight of the pulley and the rigidity of the cord, and adopting, with respect to the last element, the experiments of Coulomb. This general form of the modulus of the pulley he applies, first, to the case in which both strings are parallel, and inclined to the vertical

at any angle; secondly, to the case in which they are equally inclined on either side of the vertical; thirdly, to the case in which one is horizontal and the other vertical; and, fourthly, to that in which both are horizontal. He concludes his paper by a deduction from this last case of the modulus of a system of any number of pulleys or sheaves, sustaining among them the weight of any given length of rope horizontally.

3. "On the Nervous Ganglia of the Uterus." By Robert Lee, M.D., F.R.S.

The author, in a paper which was read to the Royal Society on the 12th of December, 1839, had described four great plexuses under the peritoneum of the gravid uterus, having an extensive connexion with the hypogastric and spermatic nerves. From their form, colour, general distribution, and resemblance to ganglionic plexuses of nerves, and from their branches actually coalescing with those of the hypogastric and spermatic nerves, he was induced to believe, on first discovering them, that they were ganglionic nervous plexuses, and that they constituted the special nervous system of the uterus. He states in the present paper, that subsequent dissections of the unimpregnated uterus, and of the gravid uterus in the third, fourth, sixth, seventh, and ninth months of pregnancy, have enabled him not only to confirm the accuracy of his former observations, but also to discover the important fact, that there are many large ganglia on the uterine nerves, and on those of the vagina and bladder, which enlarge with the coats, blood-vessels, nerves, and absorbents of the uterus during pregnancy, and which return, after parturition, to their original condition before conception took place. The author next proceeds to describe the two great ganglia situated on the sides of the neck of the uterus, in which the hypogastric and several of the sacral nerves terminate, and which he calls the *hypogastric*, or *utero-cervical ganglia*. In the unimpregnated state, they are of an irregular, triangular, or oblong shape, about half an inch in the long diameter, and always consist of grey and white matter, like other ganglia. They are covered by the trunks of the vaginal and vesical arteries and veins; and each ganglion has an artery of considerable size, which enters it near the centre and divides into branches, accompanying the nerves given off from its anterior and inferior borders. From the inner and posterior surface of each of these ganglia, nerves pass off, which anastomose with the hæmorrhoidal nerves, and ramify on the sides of the vagina, and between the vagina and rectum. From the inferior border of each hypogastric ganglion several fasciculi of nerves are given off, which pass down on the sides of the vagina, and enter some large flat ganglia, midway between the os uteri and ostium vaginæ. From these vaginal ganglia innumerable filaments of nerves, on which small flat ganglia are formed, extend to the sphincter, where they are lost in a white dense membranous expansion. From this great web of ganglia and nerves numerous branches are sent to the sides of the bladder, and enter it around the ureter. All these nerves of the vagina are accompanied with arte-

ries; and they often form complete rings of nerve around the trunks of the great veins.

The author then describes the nerves which are given off from the anterior margin of each hypogastric ganglion, some of which pass on the outside of the ureter, and others on the inside, and meet in front of the ureter in a ganglion, which he calls the *middle vesical ganglion.* There are other two ganglia, he states, formed on these nerves; one between the uterus and ureter, and the other between the ureter and vagina. These he calls *the internal and external vesical ganglia.* Not only is the ureter inclosed within a great ring of nervous matter, which, he says, resembles the œsophageal ganglia in some of the invertebrata; but the trunks of the uterine artery and vein are likewise encircled by a great collar of nervous matter, between which and the hypogastric ganglion several large and some small branches pass.

The author gives the following description of the vesical ganglia. The internal vesical ganglion, which usually has a flattened or long bulbous shape, is formed entirely upon the nerves which pass from the hypogastric ganglion, and run between the uterus and the ureter. It has an artery which passes through its centre. It first gives off a large branch to the ring of nerve or ganglion which surrounds the uterine blood-vessels; it then sends branches to the anterior part of the cervix uteri, and afterwards a great number of small filaments to the muscular coat of the bladder behind, where it is in contact with the uterus; and it then sends forwards a large branch, which terminates in the middle vesical ganglion. This ganglion sends off a great number of large nerves to the bladder. Some of these accompany the arteries, and can be seen ramifying with them upon the whole of the superior part of the organ, even to the fundus. Filaments of these nerves, scarcely visible to the naked eye, are seen in one of the preparations ramifying upon the bundles of muscular fibres, occasionally forming loops and inclosing them, or passing down between them to the strata of fibres below. Some of the smaller branches of the middle vesical ganglion do not accompany the arteries, but are distributed at once to the parts of the bladder around the ureter.

The external vesical ganglion is formed entirely upon the nerves which proceed from the hypogastric ganglion, and pass on the outside of the ureter. This is a small thin ganglion, the branches of which are sent immediately into the muscular coat of the bladder. It usually sends down a long branch to anastomose with the nerves issuing from one of the vaginal ganglia.

From the inner surface of each hypogastric ganglion numerous small white, soft, nerves pass to the uterus, some of which ramify upon the muscular coat about the cervix, and others spread out under the peritoneum to coalesce with the great ganglia and plexuses situated on the posterior and anterior surfaces of that organ. Large branches also go off from the inner surface of the ganglion to the nerves surrounding the blood-vessels of the uterus, which they accompany in all their ramifications throughout its muscular coat.

This paper is illustrated by two drawings, in which the hypogas-

tric, vaginal, vesical and uterine ganglia are delineated in the fourth month of pregnancy, and also the plexuses of nerves on the anterior surface of the uterus.

From an examination with the microscope of portions of the plexuses under the peritoneum of a gravid uterus in the ninth month, which had long been immersed in rectified spirit, Professor Owen and Mr. Kiernan inferred that they were not nervous plexuses, but bands of elastic tissue, gelatinous tissue, or cellular membrane.

The author concludes his paper with a letter from John Dalrymple, Esq., containing the results of the observations he had made with the microscope on the uterine nerves in the recent state. Filaments of the nerves which surrounded the ureter, and which were situated upon the body of the uterus, were submitted to the microscope. The instrument employed was a very powerful object-glass, whose focus was the eighth of an inch, made by Ross. Mr. Dalrymple found that it was impossible, even with the most careful dissection, to detach any filament of nerve without including a quantity of cellular and elastic tissue; so that although the tubular portion indicating the nerve was distinct, yet it was surrounded by innumerable extremely minute threads coiled and contorted, such as those which constitute the component of elastic tissue, and the ultimate element of cellular membrane. Under slight pressure, however, the tube was plainly discernible, and was found to contain granular matter, not uniformly distributed, but collected in minute masses at intervals. Small blood-vessels were also here and there seen, with blood-discs within them, which served to indicate the difference between the nervous and vascular tubes, and thus to avoid the possibility of error. Being, however, aware that some of the most distinguished foreign microscopical anatomists had differed as to what was the real characteristic of the nerves of the sympathetic system, and feeling, from this discordance of opinion, that there was no absolute test, or at least none which was not open to cavil, Mr. Dalrymple thought of making a comparison of the uterine nerves with those that undeniably belonged to the ganglionic system. He therefore traced some nerves on the surface of the stomach up to the great ganglion that gave them origin; and he selected some also from the small intestine. These he submitted to the same microscopical power, and under the same circumstances of light, and pressure, and medium. In all of these he observed the tubular part filled with granular matter, and similarly collected in minute masses. He also observed that each tube was surrounded by the minute serpentine threads before described. In fact, so closely did they agree in every particular with the appearances presented by the uterine nerves, that it would have been impossible to distinguish the one from the other.

4. "On the Corpuscles of the Blood." Part III. By Martin Barry, M.D., F.R.SS. L. and E.

After remarking that no clear conception has hitherto existed of the mode in which the floating corpuscles of the blood conduce to nourishment, the author states that he has found every structure he has

examined to arise out of corpuscles having the same appearance as the corpuscles of the blood. The following are the tissues which he has submitted to actual observation, and which have given the above result, namely, the cellular, the nervous, and the muscular; besides cartilage, the coats of blood-vessels, several membranes, the tables and cells of the epithelium, the pigmentum nigrum, the ciliary processes, the crystalline lens itself, and even the spermatozoon and the ovum.

The author then traces the nucleus of the blood-corpuscle into the pus-globule; showing that every stage in the transition presents a definite figure. The formation of the pus-globule out of the nucleus of the blood-corpuscle is referable to the same process, essentially, as that by means of which the germinal spot comes to fill the germinal vesicle in the ovum. This process, which, in a former memoir, he had traced in the corpuscles of the blood, he now shows to be universal, and nowhere more obvious than in the reproduction of the tables of the epithelium. The epithelium-cylinder seems to be constituted, not by coalescence of two objects previously single, as has been supposed, but by division of a previously single object. Certain objects, called by the author *primitive discs*, exhibit an inherent contractile power, both when isolated, and when forming parts of a larger object; an incipient epithelium-cylinder having been observed by him to revolve by this means. Molecular motions are sometimes discernible within corpuscles of the blood. The author has noticed young blood-corpuscles exhibiting motions, comparable to the molecular, and moving through a considerable space; and he has met with the nuclei of blood-corpuscles endowed with cilia, revolving, and performing locomotion. In his first paper on the Corpuscles of the Blood, he described certain instantaneous changes in form which he had observed in blood-corpuscles, and afterwards expressed his belief, that these changes were referable to contiguous cilia, although he had not been able to discern any such cilia. He now states that subsequent observation inclines him to think that these changes in form arise from some inherent power, distinct from the motions occasioned by cilia. The primitive disc, just mentioned, seems to correspond, in some instances, with the "cytoblast" of Schleiden. Thus the very young corpuscle of the blood is a mere disc; but the older corpuscle is a cell. The author minutely describes the mode of origin of the pigmentum nigrum; showing that it arises in a similar manner in the tail of the tadpole, and in the choroid coat of the eye. He had before described the Graafian vesicle as formed by the addition of a covering to the previously-existing ovisac: this covering, he afterwards stated, becomes the corpus luteum. He now confirms these observations, with the addition, that it is the blood-corpuscles entering into the formation of the covering of the ovisac, which give origin to the corpus luteum. The spermatozoon appears to be composed of a few coalesced discs. The fibres of the crystalline lens are not elongated cells, as supposed by Schwann; but coalesced cells, at first arranged in the same manner as beads in a necklace.

The author concludes with the following recapitulation:—1. The nucleus of the corpuscle of the blood admits of being traced into the pus-globule. 2. The various structures arise out of corpuscles having the same appearance, form, and size as corpuscles of the blood. 3. The corpuscles having this appearance, and giving origin to structures, are propagated by division of their nuclei. 4. The corpuscles of the blood, also, are propagated by division of their nuclei. 5. The minuteness of the young blood-corpuscles is sometimes extreme; and they are to be found in parts usually considered as not being permeable by red blood.

In a postscript, the author adds, that blood found in the heart immediately after death by bleeding, presents incessant alterations in the position of its corpuscles. Among these, when a single corpuscle is examined very attentively, it is seen to change its form; and the author is disposed to think it is this change of form that produces the alterations in position. The changes in form are slight, compared with those previously described by him as observed in blood elsewhere, and are not seen without close attention. The motions resemble those called molecular; and in the minutest corpuscles, which are mere points, nothing besides molecular motion can be discerned. It may be a question, the author thinks, whether molecular motion differs in its nature from the motion of the larger corpuscles just referred to. The division of the blood-corpuscles into corpuscles of minuter size, though apparent in blood from either side of the heart, has seemed more general in that from the left side; which, it is suggested, is perhaps deserving of notice in connexion with the subject of respiration.

5. "A new Theory of Physics, with its application to important phenomena hitherto considered as ultimate facts." By Thomas Exley, Esq., A.M.

The theory of the author is founded on the two following propositions, namely, that

1. Every atom of matter consists of an immense sphere of force, varying inversely as the square of the distance from the centre; this force being attractive at all distances, except in a small concentric sphere, in which it is repulsive.

2. Atoms differ from each other in their absolute forces, or in the extent of their spheres of repulsion, or in both these respects.

The author assumes that there are four classes of atoms, the *tenacious*, the *electric*, the *ethereal*, and the *aromatic*. The existence of the last-named class of atoms he infers from the phenomena of vegetation, the miasmata of marshes, the aroma of plants, various noxious effluvia, the disinfecting property of some bodies, and facts relating to animalcules, and their ova, &c. He regards the two propositions which constitute the great principles of his theory, as presenting, at once, a complete explication of the general attributes of matter and body, with the Newtonian laws of motion, not otherwise theoretically explicable.

After pursuing at some length his theoretical speculations, founded

on the above-mentioned propositions, the author concludes his paper with the following sentence :—

"The several partial theories of philosophers, as far as concerns the leading facts on which they are based, are contained in the simple principles here developed: thus, the theory of universal gravity is here carried out to its ultimatum; Newton and Boscovich's theories of alternate attractions and repulsions are derived from facts which depend on the alternate atmospheres, and neutral spaces of tenacious atoms; Sir Humphry Davy's theory of electrical energies, Dr. Dalton's atomic theory, and the theory of the diffusion of gases, Dr. Black's theory of latent heat, Gay-Lussac's theory of volumes, Newton's theory of light, or the theory of the emission of light, the undulatory theory, and very many others are here united in the most simple principles, which are, therefore, strongly recommended to the notice of philosophers."

6. "On the Organs of Reproduction, and on the Developement of the Myriapoda." By George Newport, Esq. Communicated by P. M. Roget, M.D., Sec. R.S.

The author commences his paper by stating that great interest attaches to the study of the Myriapoda, from the already known fact that their mode of developement, by an increase in the number of segments, is directly the reverse of that of true insects in which the developement of the perfect individual is accompanied by an apparent diminution in the number of these parts. He remarks, that although the developement of the Myriapoda has already been examined by several eminent naturalists, such as Degeer, Savi, Gervais, and Waga, some of the most important facts relating to it have, nevertheless, escaped their notice, and he proposes, therefore, to lay before the Society the result of his own investigations on this subject, and also his examinations of the organs of reproduction.

The paper is divided into four sections. In the first, the author describes the organs of reproduction, and shows that the parts described by Treviranus, both in the male and female Julus, are only the efferential ducts in the male, and the oviduct in the female; that in the former there are developed, from the sides of the efferential ducts, a large number of sacs, the structure of which he describes, and states his opinion that these are the proper secretory organs in the male, but remarks that he has not been able to follow out the organs to their fullest extent. In the female, he shows that the oviduct described by Treviranus is covered by an immense number of ovisacs, each secreting only a single ovum; that many hundreds of these exist around the duct, a large proportion of which never reach maturity, being retarded in their growth by the developement of others immediately around them; and that the ova, when matured, are passed from the ovisacs into the duct, and are then all deposited at one time. He adverts especially to the remarkable condition of the female oviduct being a single organ, throughout the greater part of its extent, but having a double outlet; and shows its analogy in the internal portion of the organs to those of some in-

sects, and in its double outlet to the Crustacea and Arachnida. He also institutes a comparison between the structure of the male and female organs in this Myriapod, which, from their simplicity, admirably illustrate the uniformity of origin of these structures; more especially the analogy between the ovisacs in the female and the cæca in the male, and also their conformity in the absence, in the latter, of separate vesiculæ seminales, and, in the former, of spermatheca.

The second section is occupied by a short account of the structure of the ovum, in which the author observes the germinal vesicle and macula. He notices especially the presence of the yelk in the earliest stages of developement, together with the vesicle and the membranes of the ovum at a later period, as showing in this low form of animal the conformity of structure and laws with those which prevail in the higher forms.

In the third section, the author speaks of the deposition of the ova, and of the habits of the species, as observed in specimens collected and preserved by him for that purpose. These habits he regards as particularly curious. The female excavates for herself a burrow, by digging with her mandibles in the soil, which she has previously moistened with a fluid, supplied, as the author believes, by her immense salivary glands. With this she forms a soft pellet, which she removes from the burrow with her mandibles and anterior legs; and thence, after being brought to the top of the hole, it is passed on to the next pair, and by these on to the next in succession, until it is entirely removed out of the way; after which, she deposits her eggs and closes the burrow with moistened clay. Great difficulty was experienced in preserving the eggs during the observations, from the circumstance that their shell is soft, and dries quickly when exposed to the air. To avoid this, the author had recourse to the plan of inclosing the eggs in a glass tube, filled with clay, and closed with a cork; the eggs being placed in a cell next to the glass.

The fourth section, which constitutes the most important part of the paper, gives the history of the evolution of the embryo. The process is divided by the author into different periods. After a few observations on the earlier changes of the egg, and the proof that they consist in an alteration in the size and appearance of the cells out of which the embryo is formed, he states his having observed that the egg bursts at the end of twenty-five days, by means of a fissure along the dorsal surface, as described by Savi and Waga; and that, in opposition to the remarks of Degeer, the young Julus, as first stated by Savi, is perfectly apodal. The author has also discovered a singular fact, entirely overlooked by all who have attended to the developement of these animals, namely, that the young Julus at this time is still an embryo, and is completely inclosed in a shut sac, which terminates in a distinct *funis* at the extremity of the body, and in the proper *amnion*, or fœtal envelope of the animal. He finds, also, that the funis enters at the posterior penultimate segment of the dorsal surface of the body, and not at the dorsal surface of the thoracic region, as seen by Rathke in the Crustacea. The embryo, he says, is retained in connexion with the shell, between the two halves of it, for seven-

teen days, by means of the funis, which is continuous with a second, or external membrane, *the chorion*, which lines the interior of the shell. He states that the liberation of the embryo from the shell is not effected by any effort of its own, but by the expansive force of the growth of its body. He describes, also, another important fact which had been overlooked by previous observers, relating to the mode and place of origin of the new segment of the body in the Julidæ. The new segments are always produced in a *germinal membrane* immediately before the penultimate segment, which segment, with the anal one, remains permanent throughout the life of the animal. The production of the first set of new segments is commenced even before the animal has burst from the amnion. After leaving the amnion, the young Julus possesses six pair of legs, as stated by Savi and Waga; but the author remarks, in addition, that, notwithstanding this, it is still inclosed in another tunic, the proper skin of the embryo, beneath which new segments are being formed, and which begins to be detached before the embryo has left the amnion. He suggests whether this may not be the representative of the proper tunic of the germinal vesicle. After minutely describing the embryo, and showing that its body is still formed of cells, he states that four pairs of new legs are forming beneath this tunic, and that, on the twenty-sixth day, the young animal throws off this covering, and the legs are developed, and also the six new segments, to a further extent. The animal then takes food, the segments become developed to the same extent as the original ones, until the forty-seventh day, when it again changes its skin, new segments are again produced, and new legs to those segments last formed. In this way it passes through several changes, developing first segments and then legs.

One remarkable circumstance stated is, that the production of segments is *sextuple* in the Julidæ; but this does not hold in other genera, in some of which it is *quadruple*, and in others *double;* but these peculiarities appear in all cases to be characteristic of each distinct genus. In conclusion, he confirms the observation already made by M. Gervais, that the number of eyes is increased as the animal advances in its transformations. The author concludes by stating that he proposes continuing these observations on the Myriapoda at some future period.

The paper is accompanied by drawings of the parts described, and of the successive changes which take place during the developement of the animal.

The Society then adjourned over the long vacation, to meet again on the 18th of November next.